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THE VALUE OF STETHOSCOPIC PERCUSSION IN MEDICAL DIAGNOSIS.

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FROM

THE MEDICAL NEWS,

October 28, 1893.

[Reprinted from THE MEDICAL NEWS, October 28, 1893.]

THE VALUE OF STETHOSCOPIC PERCUSSION IN MEDICAL DIAGNOSIS.[1]

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THAT it is through the means of physical exploration that medical diagnosis most nearly approaches an exact science is a doctrine that should be fruitful in good results. When a method of physical examination for which masters in medicine have claimed unusual advantages has not come into general use, there must be some strong and practical reason for it; and it will be the object of this paper to point out that reason, and to urge the value in physical diagnosis of the application of stethoscopic, or as it is more commonly termed auscultatory percussion.

In 1840 Drs. G. P. Camman and Alonzo Clark published in the *New York Journal of Medicine and Surgery* an article entitled "A New Mode of Ascertaining the Dimensions, Form, and Condition of Internal Organs by Percussion." These authors recommended in carrying out their method a special

[1] Read before the Pan-American Medical Congress, Washington, September, 1893.

form of stethoscope made of a single piece of wood, some six inches long and an inch in diameter, wedge-shaped at the extremity to be applied to the body, and broad at the other to fit the ear of the observer. Percussion was carried out by the use of a pleximeter, which was presumably manipulated by an assistant. No work that has been done on this subject bears the evidence of such exact and thoughtful observation as that of Camman and Clark, and their own words form an admirable description of the application and results of the method. They say:

"The observer, suppose, practises first over the heart, listening and percussing on the same region. With each blow of percussion the ear receives a sudden, clear, intense sound of high tone, attended with a degree of impulse, even painful, appearing to be immediately under the instrument or produced within it, of short duration, and ending with some degree of abruptness. Now find the longest diameter of the heart in contact with the walls of the chest; it may be three inches; listen at one extremity and percuss at the other. The sound is the same in character and has lost little of its energy. Percuss at the point where the lung begins to overlay the heart, the sound is instantly modified and mixed, yet its cardiac type is still preserved. Recede still further with percussion, moving by short steps toward the body of the lungs; at a certain point the sound suddenly changes. It loses its intensity and high tone; it is no longer impulsive; it is grave and distant, much more distinctly heard by the open ear than by that applied to the instrument. Again, let the observer in like manner explore the hepatic region. Within short distances the sound

is sudden, clear, intense, and immediately under the instrument as before; yet it is less intense, less acute and more prolonged; it is even semi-reverberant. As he increases the distance between the points of auscultation and percussion, the sound diminishes more rapidly than over the heart, though it is not entirely lost till percussion passes off from the organ on to another medium. By this mode of exploration, the heart and liver become distinguishable through a class of signs which, judging even from the analogous consistency of these organs, would not be supposed to exist."

In 1880 T. A. McBride described (in the *New York Archives of Medicine*) a form of binaural stethoscope, composed of solid wooden pieces, by which auscultatory percussion could be conveniently carried out by a single observer. These authors restricted themselves chiefly to the determination of the outlines of the heart and liver. Various other observers, including Roussel,[1] de Mussy, Zuelzer,[2] and, according to Weil, even Laennec and Piorry, have called attention to the facility with which organs and morbid growths could be differentiated by the stethoscope applied to one side of the chest while percussion is carried out by an assistant on the opposite side. It is extraordinary, as is remarked by McBride, that, in the recognized treatises on physical diagnosis, the method of auscultatory percussion has received but little attention and no indorsement. Gerhardt[3] appears to make no refer-

[1] Quoted by McBride.

[2] Berlin. klin. Wochenschr., 1877.

[3] Lehrb. d. Auscult. u. Percussion.

ence to it. Weil[1] speaks slightingly of the method and declares that, as a rule, it offers no special advantages. Loomis[2] and Page[3] mention the procedure on the authority of Camman and Clark; Gemmel[4] incompletely describes it; but all these writers refer to the subject as if at second hand, as if they had failed to give it personal investigation. It is, therefore, not surprising that the active members of the medical profession are, for the most part, either wholly unfamiliar with the practical application of auscultatory percussion, or, in isolated instances, only use the method when some accident of experience has illustrated its value.

The reasons why physical examination by the method of stethoscopic or auscultatory percussion has not come into general use are not far to seek. In the first place, the mechanical impediments to the pursuit of the practice have been made burdensome; special forms of stethoscopes, useful only in this particular kind of examination, have been recommended, and, usually, the services of a skilled assistant are required, to carry out the observations. In the second place, most descriptions of the findings of stethoscopic percussion enter so fully into the pitch and quality-differences of sound elicited by percussion of various organs as would manifestly need for their appreciation such a musical cultivation and training in the physics of acoustics as might well discourage the student in medicine from attacking so cumbersome a method.

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[1] Topograph. Percuss. [2] Physical Diagnosis.
[3] Physical Diagnosis.
[4] Finlayson's Clinical Diagnosis.

I have never employed the special instruments described by Camman and Clark and McBride, though it seems probable that the results so obtained must be particularly striking and accurate. But it is the particular design of this essay to show that auscultatory percussion may be advantageously and readily carried out by any single observer who uses a stethoscope; that it is the easiest of all methods of physical examination; that it allows the accurate outlining of organs and deposits impossible of delimitation by ordinary means, and that, though capable of extensive development as a means of diagnosis under the acoustic skill of the observer, its limitations are so well marked as to instruct, without confusing, any ear that can hear.

My own work has been done with the simplest form of binaural stethoscope. The diameter of the bell to be applied to the body is five-eighths of an inch at its mouth, so that it can usually be inserted between the ribs of a patient. It should be remarked, however, contrary to McBride's statement, that, by this method, it makes little apparent difference whether the mouthpiece of the stethoscope overlaps the ribs or lies wholly between them.

I was first impressed with the value of auscultatory percussion on attempting to outline the stomach in the case of an old man the victim, apparently, of chronic peritonitis, whose intestines were inflated with gas. It was not possible by ordinary percussion to determine the lower border of the stomach. The stethoscope was applied over the upper left border of the epigastrium, and with the pulp of the middle finger of the right hand the abdominal wall was

gently tapped, so gently that no sound was audible to the unaided ear, the finger being carried in a straight line from the stethoscope outward. With each blow of the percussing finger a peculiar shock, with a certain loudness and quality of sound, was conveyed to the ear, gradually decreasing in intensity as the percussing finger receded from the stethoscope until a certain point was reached ; then the loudness of the tone and the intensity of the shock suddenly diminished ; at the same time the quality changed, but it is desired to especially observe that quality-differences in sound are to be left to the unconscious appreciation of the examiner and are not to be depended on in this description. Having marked the spot at which this change in sound occurred, the percussing finger was carried from the stethoscope as a center along other radii, and it was found that the line joining all the points so determined represented the shape of the greater curvature of the stomach. Whenever the outline of an organ was determined in this manner the result was verified by placing the stethoscope outside its limits and percussing up to it. It frequently occurs that the boundary between two adjacent organs can be more readily determined when auscultation and percussion are performed on one than on the other.

In outlining an extensive body, as the stomach or the liver, it is frequently of advantage to shift the position of the stethoscope along the line of percussion. I have paid more attention to the determination of the outlines of the stomach than of any other organ, because the difficulties to be

overcome are in this case, perhaps, on the whole the greatest. In six different autopsies the stomach was outlined in the manner described, the boundaries being marked by inserting pins into the abdominal wall perpendicular to the surface, and their position among the viscera afterwards determined by section. In one of these cases the stomach was dilated, reached far into the right hypochondrium, was wholly covered by an enlarged liver, and the abdominal cavity contained free gas. In another the stomach was contracted into the form of a tube having a diameter of less than two inches. Nevertheless the greater curvature of the organ was outlined in each case with almost perfect accuracy. The greatest error occurred in a case in which the border of the stomach lay just under the free margin of the ribs; one pin was found to have been inserted into the stomach three-fourths of an inch from its edge, and another half an inch below it. It is worthy of remark that, although the stomach and colon are thus usually distinguishable, the stomach and duodenum do not appear to be, and my pins sometimes traced the course of the gut for a distance beyond the pylorus. Leichtenstern, quoted by Weil, used a somewhat similar mode of stethoscopic percussion to differentiate stomach from colon, depending, however, on the pitch and quality of the notes elicited from the two organs. But it is worthy of being insisted on that, though the pitch and quality of the percussion note vary with the organ struck, and at least unconsciously are appreciated by the examiner, the most important factors to be noticed when the percussing finger passes from one

organ to another are the changes in loudness and shock of the note.

In those not infrequent instances in which the stomach gives to ordinary percussion a dull sound, stethoscopic percussion is at no loss to distinguish the true boundaries. In a recent clinical case in which this stomach-dulness made it impossible to outline in the ordinary way the contiguous borders of liver, spleen, and lung, the difficulty disappeared at once upon the use of the stethoscope.

In another patient in whom the determination of the superficial area of the liver was of great importance, the liver-dulness as made out by ordinary percussion extended only over one costal interspace; stethoscopic percussion, however, showed that the liver reached the margin of the ribs, giving the organ a normal volume. The next day, after free purgation, the normal limits of liver-dulness were determinable by ordinary percussion.

Probably few examiners are capable of outlining with certainty the border between the liver and a superincumbent pleural effusion; by stethoscopic percussion, however, the separation is easily determined. In an autopsy in a case of pyo pneumothorax it was found possible to define within one-fourth inch the boundaries of both relative and absolute liver-dulness, as verified by aspiration of the fluid and by section. To fix the line of division between air and fluid involved, of course, no difficulty.

The method offers valuable assistance in determining the level of effusions, pleuritic or abdominal. In the latter case spleen, liver, and kidneys can

easily be distinguished. The splenic borders are readily determined when obscured to ordinary percussion by contact with a distended stomach.

The cranial sutures can usually be made out by stethoscopic percussion of a bald head or shaven scalp. I have watched in vain for an opportunity to outline, if possible, a superficial brain-tumor.

The most interesting application I have found for this method was in a case of pneumonia in which an encysted empyema developed outside the lower lobe of the left lung. The pus touched the chest-wall in contact with and parallel to the sixth and seventh ribs throughout their anterior and lateral portions. Neither by ordinary percussion nor by auscultation could the empyema with certainty be distinguished from the adjacent solid lung tissue; but by stethoscopic percussion the cyst was outlined, and my colleague at the County Hospital, Dr. John Boice, resected a rib near the lowest point of the area so determined, and declared that no better place of incision could have been chosen. Had the chest been opened in the ordinary region the cyst would have been missed altogether. In another case, one of a large empyema, encysted over the liver, stethoscopic percussion assisted the surgeon by exactly locating the top of the latter organ.

The delicacy of this method is nowhere better illustrated than in examination of the normal lungs. When the stethoscope is placed over one lobe and the percussing finger is made to travel across to another, there is a distinct change in the sound as the interlobular fissure is passed. Though but little attention has been paid to this part of the subject,

I have on two occasions at autopsies inserted long needles with considerable accuracy into the line of the interlobular fissures as determined by auscultation percussion.

The limits of usefulness of the method of stethoscopic percussion as thus described are obvious. While a trained ear by the aid of special instruments, such as those devised by Camman and Clark and McBride could, no doubt, determine the physical condition of the organs investigated, as to their fluid, solid, or gaseous contents, the present paper does not treat of this possibility. The sudden diminution in the shock and intensity of an auscultation-percussion note as the body-surface is tapped by the finger moved along radii centering in the stethoscope simply means that the percussion has reached an organ, growth, or effusion outside that over which the stethoscope is placed. This result is altogether to be expected, as vibrations set up in any homogeneous body must suffer great diminution in energy whenever transmitted to an adjoining body of whatever consistence. Stethoscopic percussion must be used in conjunction with ordinary percussion and with consideration of topographic anatomy. For example, the position of the border of the left lung upon the heart can usually be accurately determined; but whether or not this line marks the lower or upper margin of the heart, the sound elicited does not make clear.

In fact, twice at autopsies needles were inserted into the margin of the lungs covering the heart, with the thought that the lower border of the latter

organ had been outlined; further experience corrected such mistakes.

An advantage possessed by the method of stethoscopic percussion deserving of special mention is the feeling of certainty with which its results usually impress the examiner. In post-mortem observations I have been interested to note that when stethoscopic percussion had given distinct evidence of the outlines of organs, no mistake was ever made. On the other hand, whenever an error was committed, the examination itself had been dubious in its indications.